

IN THE CLAIMS:

Claim 1 (Currently Amended): A direct injection fuel injector having a fuel inlet, a fuel outlet, and a fuel passageway extending from the fuel inlet to the fuel outlet along a longitudinal axis, the fuel injector comprising:

a body having an inlet portion, an outlet portion, a neck portion disposed between the inlet portion and the outlet portion, the neck portion including a metallic cylindrical annulus that provides a body passage extending from the inlet portion to the outlet portion along the longitudinal axis of the fuel injector;

an armature proximate the inlet portion of the body;

a cylindrical needle operatively connected to the armature;

a seat disposed at the outlet portion of the body, the seat having a passageway providing a fuel distribution outlet through the passageway, the seat including a circumferential portion disposed within the body and directly connected to the interior surface of the body so that the circumferential portion extending along the longitudinal axis within the body is contiguous to the interior surface; and

a swirl generator proximate the seat, the swirl generator having a guide disk contiguous to a flat disk, each of the guide disk and flat disk having a first surface generally parallel to a second surface extending from an outer perimeter to a central aperture of respective disks, the flat disk having a central aperture and an equal number of apertures axially in-line with the apertures angularly spaced in the guide disk and having a slot means extending from each of said angularly spaced apertures tangentially to said central aperture so that the seat with the swirl generator forms an assembly welded to the body as fuel flows through the apertures in the guide disk and is metered and directed in a tangential direction to the central aperture in the flat disk;

wherein the cylindrical annulus of the body includes an inner diameter that is greater than a diameter of the cylindrical needle so as to define the body passage, which maintains an operative relationship between the body and the needle when the body is exposed to operating temperatures of a cylinder of an engine.

Claim 2 (Original): The fuel injector of claim 1, wherein the inner diameter of the cylindrical annulus is no more than 50% greater than the diameter of the cylindrical needle, and an outer

diameter of the cylindrical annulus is no less than 100% greater than the inner diameter of the cylindrical annulus.

Claims 3-9 (Canceled)

Claim 10 (Previously Presented): A fuel injector having a fuel inlet, a fuel outlet, and a fuel passageway extending from the fuel inlet to the fuel outlet along a longitudinal axis, the fuel injector comprising:

- a body having an inlet portion, an outlet portion, and a body passage extending from the inlet portion to the outlet portion along the longitudinal axis;

- an armature proximate the inlet portion of the body;

- a needle operatively connected to the armature, the needle includes a curved surface that engages with a conical end of the funnel to inhibit fuel flow through the seat passage of the seat;

- a swirl generator proximate the needle, the swirl generator comprises at least one flat disk, the at least one flat disk includes:

- a guide disk having a perimeter, a central aperture, and at least one fuel passage opening between the perimeter and the central aperture; and

- a swirl disk having at least one slot extending radially from the at least one fuel passage opening to the central aperture so that a portion of the slot is tangential to the central aperture;

- a seat protruding from the outlet portion of said body, the seat including a first surface exposed to the body passage and a second surface exposed to an exterior of the fuel injector, the first surface being spaced from the second surface a defined distance along the longitudinal axis, the first portion having at least one cut-out configuration that extends from the first surface for a fraction of the defined distance into an interior of seat wherein the at least one cut-out comprises at least one volume that defines at least one wall in the interior of the seat, the at least one volume comprises one of a plurality of volumes and a channel, wherein the seat includes a seat passage, the seat passage including a funnel extending between the first surface and the second surface.

Claim 11 (Original): The fuel injector of claim 10, wherein the at least one fuel passage opening comprises a plurality of fuel passage openings between the perimeter and the central aperture; and the at least one slot of the swirl disk comprises a plurality of slots that corresponds to the plurality of fuel passage openings in the guide disk.

Claim 12 (Original): The fuel injector of claim 11, wherein the at least one volume comprises a plurality of volumes arranged in the first surface to correspond to the plurality of fuel passage openings.

Claim 13 (Original): The fuel injector of claim 12, wherein each of the plurality of volumes comprises a cylindrical volume having a first diameter, and wherein the each of the plurality of fuel passage openings comprises a circular aperture having a second diameter, the first diameter being substantially equal to the second diameter.

Claim 14 (Original): The fuel injector of claim 13, wherein the at least one wall defined by each of the cylindrical volumes comprises a cylinder side wall and a cylinder end wall in the interior of the seat.

Claim 15 (Original): The fuel injector of claim 14, wherein the cylinder end wall is located between the second surface and a midpoint along the define distance from the first surface and the second surface.

Claim 16 (Previously Presented): The fuel injector of claim 10, wherein the channel comprises a width on the first surface, and wherein each of the plurality of fuel passage openings comprises a circular aperture with a diameter, the diameter of one of the fuel passage openings being substantially equal to the width of the channel.

Claim 17 (Original): The fuel injector of claim 16, wherein the channel comprises a continuous channel, and wherein the at least one wall defined by the continuous channel comprises an inner

side wall, an outer side wall, and a channel end wall engaging both the inner side wall and the outer side wall.

Claim 18 (Original): The fuel injector of claim 17, wherein the channel end wall is located between the second surface and a midpoint along the define distance from the first surface and the second surface.

Claim 19 (Previously Presented): The fuel injector of claim 10, wherein the body comprises a neck portion, the neck portion including a cylindrical annulus that surrounds the needle, the needle being a substantially cylindrical needle; and

wherein the cylindrical annulus comprises an inner diameter and an outer diameter, the inner diameter that is no more than 50% greater than a diameter of the cylindrical needle, and an outer diameter that is no less than 100% greater than the inner diameter.

Claims 20-23 (Canceled)